RESPONSE OF POTATO (*Solanum tuberosum*)
CULTIVARS TO IRRIGATION LEVELS AND HARVEST DATES

by

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INTRODUCTION

Solanum tuberosum, the white potato, is grown in nearly every country in the world. Production of potatoes in 1967 in the major producing countries of the world was estimated at 5,285 million hundred weight. The potato leads all other vegetables grown in the United States in value, and is exceeded in total acreage only by dry beans. MacFarland (27) reported that the 1967 potato crop in the 48 conterminous states was estimated at 306 million hundred weight. Although per capita consumption in U. S. of fresh potatoes is decreasing, total potato consumption is holding steady. Processing into potato chips and other dry and frozen products has offset the decline in fresh potato consumption. Thirty percent of the total crop is now processed by canning, dehydration, freezing, and chipping.

The potato is a cool-season crop, but is only moderately tolerant of frost. Temperature during the growing season has long been recognized as one of the most important factors influencing yield of potatoes. Bushnell (5) was one of the first to point out the importance of temperature on tuber production. He found that increasing the growing temperature decreased the production of tubers. Respiration in the above ground portion of the plant increased with temperature, reducing the amount of carbohydrates available for translocation to the tubers. The optimum temperature for tuber yield was 17°C (63.0°F). Above 17°C, yield rapidly decreased.

The potato is a shallow rooted crop, and gives good response to irrigation in most areas. In arid regions potatoes are irrigated at frequent intervals until the tubers are well formed, and then the interval is gradually increased but less water is applied per application. Excessive irrigation after the tubers are formed may reduce the yield because of rotting of the tubers. Many tuber abnormalities are the result of widely fluctuating moisture supply. During low soil moisture supply, the tuber makes little if any growth and the cells tend to mature. A sudden increase in soil moisture may then result in growth cracks, second growth and knobby tubers that are not marketable. Many of these abnormalities are eliminated when irrigation is used to ensure a continuous supply of available soil moisture for growth of the plant.

Potatoes vary in size, color, skin smoothness, storage ability, time of maturity, yield and quality. No one potato variety can meet all these characteristics perfectly. It is important to know how different varieties will produce under a specific system of management because different varieties are grown for different purposes. Varieties of potatoes for fresh use and those to be processed have a number of characteristics in common. Potatoes with high percentage of solids are preferred.

Stevenson *et al.* (41) reported that there are genetic differences amoung varieties and seedlings in their ability to produce high solids but often the differences due to environ-

ment are greater. He also reported that chip quality is a complex of many characters. Color is one of the most important characters of potato chips. Dark brown chips may have an undersirable flavor and are unattractive. Chip color and the percentage of sugar in potato tubers depend on many factors, both hereditary and environmental as well as methods of culture, handling and storage. Some potatoes are not suitable for processing into potato chips. Dry matter content must be high to yield a high percentage of chips.

Mealiness, consistency of cooked potatoes, is also an important quality factor in the processing industry and the fresh market. A mealy potato has a relatively dry, flaky texture after cooking; crumbles readily when mashed; and gives a dry floury mash. Various physical and chemical factors are considered to be associated with potato texture. The starch content of the cells is believed to be the principal factor in determining potato texture. The specific gravity of tubers is used to provide a rapid measure of dry matter and starch content.

Lujan and Smith (25) reported that different varieties of potatoes of identical specific gravity differ in mealiness. The degree of difference may depend on the specific varieties subjected to comparison and the sensitivity of the test used. Within each variety, the mealiness of cooked tubers is highly correlated with the specific gravity of raw tubers.

The objectives of this study were:

1. To evaluate four potato cultivars grown under different irrigation levels and harvested at different dates for yield and quality characteristics.
2. To study the effect of different soil moisture levels on yield and specific gravity of four cultivars.
3. To determine chip color of freshly harvested and stored tubers of different cultivars grown under different soil moisture levels.

REVIEW OF LITERATURE

Edmundson (11) reported that, since potatoes are a shallow-rooted crop, the application of 2 to 4 inches of water at frequent intervals is preferable to 4 to 5 inches at less frequent intervals. He also reported that irrigation increased yield of potatoes from 60 to almost 300 per cent.

In Utah, Widstoe and Merill (48) obtained the greatest yield with 60 inches of water but this resulted in poor quality. Twenty inches of water was next in yield and produced a larger amount of quality potatoes. They also found that an application of approximately 2½ to 3 inches of water per application gave the best yield and quality.

Powers (33) in the Williamette Valley, obtained maximum yields with 2 to 3 inches of water in a wet year and 5 to 6 inches in a dry year. He also reported that light irrigation of

approximately 2 to 3 inches per application seemed best and yield was increased about 150 percent.

Pratt *et al.* (32) reported that irrigation was profitable in upstate New York each year of a 4 year study. Best results were obtained by irrigating when the soil moisture had dropped to 50 percent of field capacity.

Struchtemeyer *et al.* (44) found a significant increase in yield and number of tubers for Katahdin potatoes grown in Maine if irrigated when the available soil moisture level reached 50 percent. Yield of tubers decreased as available soil moisture decreased and the moisture stress produced more pronounced effects on tuber yield when it occurred in the last half of the growing season.

Ware (47) reported that irrigation may be of greater value to the fall potato crop than the spring crop in Alabama because rainfall during fall is usually low and temperatures are high.

Motes (29) found that the response of potatoes to various soil moisture regimes differs between years. He also reported that vine dry weight, tuber number, tuber weight and specific gravity were increased 1 out of 2 years by supplemental irrigation and the optimum irrigation level for vine weight and tuber weight varied between years.

Robins and Domingo (35) found that in three experiments conducted in Washington state, total yield of the Russet Burbank variety was reduced by 6 to 30 percent and yield of U.S. No. 1 grade was reduced by 17 to 58 percent by soil moisture stress

treatments. Also an increased incidence of spindled tubers was observed when the stress occurred early to mid season.

Cykler (10) reported that high yields of potatoes can be obtained by keeping the water content of the soil at a high level throughout the irrigation season and never letting the moisture content fall below one half the difference between the moisture content at field capacity and permanent wilting point. Tuber set was independent of the variations in the moisture content of the soil as long as available water for plant growth is present. Bradley and Pratt (3) reported that maintaining a high moisture level resulted in better top growth, earlier tuber set, and a greater weight of tubers. The major effect of moisture level on tuber set seemed to be on the earliness of set rather than the total number of tubers set. The same workers (4) reported that potato yields were higher when irrigated before the available moisture dropped much below 50 percent especially on light-textured soil whether the rooting zone was filled to field capacity or whether only one inch of water was applied by irrigation. In the former situation, the major effect of irrigation was to increase the average size of the tubers above two inches. In the latter situation the major effect of irrigation was to increase the number of potatoes over two inches while the average size of tubers varied only slightly. Jacob et al. (18) reported that over-irrigation resulted in reduction of yield or a failure to get enough increase in yield. The exact optimum level of minimum soil

moisture varied from year to year but it seemed to be around 20 to 40 inches of mercury tension or about 50 to 60 percent of field capacity. Irrigation that increases yield of potatoes very seldom reduces the specific gravity and is more likely to increase it.

Jones and Johnson (20) reported that higher yields resulted if potatoes were irrigated when soil moisture tension reached 0.3 atmosphere than at higher tension levels. Droughts occurring early in the season were not as detrimental to yield as those occurring later.

Price and Blood (34) observed that irrigation may not proportionately increase the yield of U. S. No. 1 potatoes. Irrigation per se may lower the specific gravity of potatoes but not enough to seriously affect marketability.

Smith (37) reported that high soil moisture later in the growing season lowers specific gravity of tubers and this results in darker chip color.

Lyman and Mackey (26) found that Russet Burbank cultivar tubers of high specific gravity produced chip color lighter than tubers from low specific gravity. Cunningham and Stevenson (9) found chip color to be highly heritable. They also reported that chip color and specific gravity were not closely associated, but could be improved by breeding.

Terman et al. (46) reported that Katahdin cultivar tubers harvested weekly from green vines increased in specific gravity from 1.038 on July 15 to 1.073 on August 24 but decreased by

the September 7 harvest date. Also, tubers, from plots that had the vines pulled weekly and all tubers dug at the end of growing season, showed little difference in specific gravity for different dates of vine removals.

Kunkel et al. (21) found that high specific gravity potatoes (mean value 1.0916) averaged almost 3.5 percent more salable chips than low specific gravity potatoes (mean value 1.0777). The color of the chips made from the high specific gravity potatoes was lighter and preferable to that of the chips mad from the low specific gravity tubers.

Akeley et al. (1) reported that, although seasons differ and the percentage of total solids vary with the season, it is evident that over a period of years, significant losses in dry matter content are sustained if the vines are killed early. They also reported that the color of chips varies with the variety and with the maturity of the potato. Chips with satisfactory color can be made from some varieties when they are relatively immature but the color of chips made from most varieties improves as the tubers reach maturity.

Sweetman (45) found that tubers containing a high sugar content or tubers dug in the immature state produced darker and more uneven colored chips.

LeClerg (23) reported that soil and climatic conditions for plant growth did not materially influence the relationship between specific gravity and dry-matter content of potato tubers. Neither specific gravity nor dry-matter content was significantly correlated with weight of tubers.

The same investigator (24) found that a significant interaction of varieties x years existed in studying the dry-matter content of 10 varieties in 1944 and 1945. Some varieties behave in a differential manner with regard to the influence of environmental conditions on the percentage of dry matter.

Hoover and Xander (16) reported that a direct correlation between specific potato components and chip color was found only in the occurrence and relative level of the monosaccharide reducing sugars (glucose and fructose). Increasingly darker chipping color consistently corresponded to the presence in the potatoes of increased quantities of one or both of these compounds.

Hope et al. (17) reported that mature potatoes produced chips of lighter color than immature potatoes due to higher reducing sugar levels in immature tubers. Nitrogen application rate exerted an influence on chip color which was independent of its effect on maturity. Excessive N reduced the trend of lighter chip color.

Findlen (12) found that fertilizers (N P K) had no important effect on chip color. The higher rates of N application reduced chip yield slightly. This was particularly noticeable with the Kennebec cultivar at harvest time. Chips prepared from the Irish Cobbler cultivar were of slightly poorer color but with slightly higher yield than the Kennebec cultivar.

Kushman *et al.* (22) reported that the poor color of chips made from potatoes grown under high soil moisture was always apparent after storage at 60°F and sometimes immediately after harvest. This might be due to an accumulation of carbon dioxide in the tubers.

Miyamoto *et al.* (28) reported that tubers subjected to either wet air or 10 percent carbon dioxide produced dark color chips.

Stewart and Coney (45) and Smith (37) reported that potatoes from cold fields (60°F or lower) should be protected from low temperature during subsequent transit or holding because the effects of low temperature are additive. Potatoes exposed to low field temperature before harvest would produce darker chips than those exposed to warmer temperatures, even though both were handled the same after harvest.

Yamaguchi *et al.* (49) reported that the optimum soil temperature for tuber formation was between 60 and 75°F. Many stolons were initiated at soil temperatures of 50-55°F but tuberization is delayed and long stolons developed. Potatoes grown with soil temperature below 60° F and above 75° F gave lower yield, specific gravity, and starch content; however, sugar content was higher. Beal *et al.* (2) reported that many of the varieties tested showed the most chip color reversion after either 50 or 95° F storage, especially if held 10 days at these temperatures. Less reversion occurred when tubers were stored at 65° F and very little when they were stored at 80° F.

They also reported that Kennebec cultivar is one of the best commercial chipping varieties. It showed much reversion when its tubers were stored at either 50 or 95° F, but less following storage at 65 or 80° F.

Smith (38) reported that when freshly harvested potatoes were treated with sulfur dioxide gas and stored at 40 to 50° F, sugar accumulation was retarted. Light colored chips were made from these potatoes for a period of 6 weeks at 40° F and longer when stored at 50° F.

Johansen and Hanson (19) reported that the varieties of Irish Cobbler, Kennebec and selection ND. 3324-2 produced light colored chips after reconditioning four weeks. The varieties and selection with a high specific gravity produced the highest chip yield. The varieties Kennebec, Norland, Irish Cobbler and ND 3324-2 grown under nonirrigation produced light colored salable chips after four weeks reconditioning and, in the irrigated trial, the varieties Irish Cobbler and Kennebec produced the lighter colored chips after four weeks reconditioning.

Clegg (7) reported that early harvested potatoes (immature) can be held for less than three days before going out of condition for chipping purposes. Delaying the harvest of potatoes lengthened the period during which potatoes could be stored and still make acceptable chips. The same workers (8) reported that high sucrose content of immature early harvested potatoes may be indirectly involved in after harvest darkening of potato chips.

A low sucrose content was necessary for good storage quality.

MATERIALS AND METHODS

This experiment was conducted in the summer of 1968 on the horticultural farm at Kansas State University. It was a factorial experiment with completely randomized design. Blocks and irrigation treatments were confounded with moisture levels. The Sarpy fine sandy loam soil was prepared in good physical condition. Uniform seed pieces, approximately $1\frac{1}{2}$ ounces in weight, of Kennebec, Irish Cobbler, Anoka and Norchip cultivars were planted March 25. Seed pieces were planted twelve inches apart in forty inch rows. The experiment was fertilized with 87 lbs/A nitrogen and 42 lbs/A P_2O_5 applied in a band beside and below the seed pieces at planting. An additional 30 lbs/A nitrogen, from ammonium nitrate, was applied as a sidedressing on June 3. The irrigation treatments were as follows:

(a) Irrigated when tensioneters reached 0.30 atmospheres (referred to as high irrigation level).

(b) Irrigated when tensiometer reached 0.60 atmospheres (referred to as low irrigation level).

(c) No irrigation, (referred to as rainfall).

Tensiometers were placed at 6, 12 and 18 inches depth to follow the soil moisture during the growing season. Irrigations were based on the average of 6 tensiometers per block at depths of 6 and 12 inches. Moisture levels were recorded tri-

weekly and soil moisture blocks were irrigated when the average 6 and 12 inch depth soil moisture tension readings were 0.30 and 0.60 atmospheres. Soil moisture tensions records are presented in Table 1 and Plate 1, Figure 1. Rainfall during the seven weekly period and number of irrigations are presented in Table 4. This period was from June 3 to July 26. Water was applied by an overhead sprinkler system that applied water at a rate of 0.17 inches per hour. Soil temperatures recorded 4 inches below the surface of the row are presented in Table 2 and Plate 1, Figure 2. Air temperatures and rainfall were recorded from thermograph and rain gauges placed in the field. This record is in Table 3 and Plate 1 Figure 3.

The cultivars were harvested at three different dates from each of the soil moisture levels: July 8, 17 and 26. Good management practices were followed to control insects, diseases and weeds.

Thirty six plots were harvested at 10 days intervals. The fresh and dry weight of vines was recorded for each plot. Vines were cut at soil surface and harvested immediately prior to harvesting the tubers. These weights indicated the relative quantity of foliage per cultivar at various irrigation levels as well as maturity of the plants at each harvest date. The tubers were dug with a Champion potato digger. Total tuber weight and U. S. No. 1 (2 inches in diameter and larger) tuber weight were recorded.

Specific gravity was determined by the weight in air-weight the in water method. Tubers were shipped via air express to Frito-Lay-Research Laboratory, Inc., Irving, Texas, to determine the chip color of each treatment at harvest and after 10 days storage at 70° F and 85 percent relative humidity. The potatoes were peeled in an abrassive type peeler and sliced at approximately 50 thousands of an inch. The slices were fried in a Hotpoint Fryer (Model HK-3) in peanut oil. The normal starting temperature for frying was 350° F and it decreased to about 330° F at the end of the frying operation which is determined by cessation of bubbles coming from the chips. Chips were ground so that they passed through an 8 mesh screen, then they were compressed. A Photovolt Model 610 Reflectance meter was used to measure the reflectance of each compressed sample. A standard with a value of 31 was used as a reference for chip color. Chip color of 28 is normally the lowest commercially accepted color. High values indicate lighter color.

Table 1. Mean soil moisture tensions in atmospheres by weekly intervals.

Dates	Treatments		
	.30 Atm	.60 Atm	Rainfall
June 3	.37	.69	.62
10	.38	.68	.66
17	.17	.15	.34
24	.35	.47	.57
July 1	.25	.42	.54
8	.15	.22	.45
15	.22	.44	.56
22	.18	.35	.41
Mean	.26	.43	.52

Table 2. Weekly average soil temperature at 4 inch depth during growing season from June 3 to July 22, 1968.

	Temperature °F		
Dates	.30 Atms	0.60 Atms	Rainfall
June 3	72	71	73
10	69	69	70
17	74	74	76
24	67	65	71
July 1	69	71	73
8	75	76	78
15	76	77	78
22	75	75	77

Table 3. Weekly average air temperature during growing season from June 3 to July 22, 1968.

Dates	Temperature °F		
	Max.	Min.	Ave.
June 3	83	50	67
10	85	62	74
17	97	68	83
24	93	66	80
July 1	97	61	79
8	100	72	86
15	99	72	86
22	79	58	69

Table 4. Inches of irrigation water applied by treatments during the growing season in addition to rainfall.

Dates	0.30 SMT/Atm	0.60 SMT/Atm	Rainfall
June 3	1.02	0.68	0.22
10	0.68	0.68	1.60
17	--	--	1.18
24	0.68	--	--
July 1	1.02	1.70	0.37
8	--	--	0.80
15	0.85	--	.75
22	1.36	--	1.00
Total	5.61	3.06	5.92

EXPLANATION OF PLATE I

Fig. 1 Soil moisture tensions at the 6 to 12 inches depth during the growing season on high irrigated (0.30 SMT) low irrigated (0.60 SMT) and rainfall plots.

Fig. 2 Soil temperature at 4 inch depth during the growing season for high irrigated (0.30 SMT), low irrigated (0.60 SMT) and rainfall plots.

Fig. 3 Mean weekly maximum and minimum air temperature during the growing season, records taken from the thermograph in the field.

PLATE I

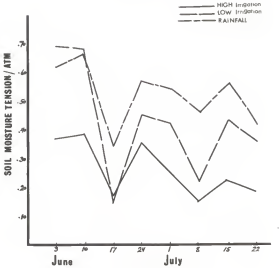


Figure I

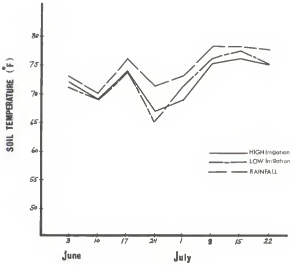


Figure 2

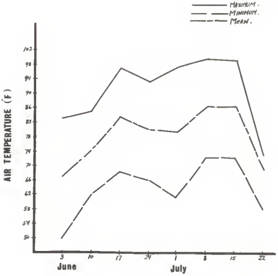


Figure 3

EXPERIMENTAL RESULTS

Characteristics of potatoes studied in this experiment were: vine dry weight, total weight of tubers, total weight of the U. S. No. 1 tubers, specific gravity, chip color initial, chip color after 10 days storage and chip color reversion.

Vine dry weights. Results were significantly different between cultivars (Table 5). The Kennebec cultivar was significantly greater in vine dry weight than Irish Cobbler, Anoka and Norchip cultivars. Significant differences occurred in vine dry weight between different soil moisture treatments. Significantly higher vine dry weight occurred with .60 SMT/Atm than from the non irrigated treatment, but significant differences did not occur between the .60 and .30 SMT/Atm or between the .30 SMT/Atm and nonirrigated treatments. Significant differences occurred for vine dry weight among the three different harvest dates. Vine dry weight was significantly larger from the second harvest (July 17) than from other harvests. Significant differences did not occur between the first and third harvests in vine dry weight. Vine dry weight of plants at the third harvest date significantly decreased due to loss of leaves at this period. A significant interaction in vine dry weight occurred between dates and cultivars. Kennebec had significantly greater vine dry weight at the second harvest than any other cultivar. At the first harvest, Kennebec had significantly more vine dry weight than Irish Cobbler and Anoka, but no

Table 5. Vine dry weight (lb per ten plants) of four potato cultivars harvested at ten days intervals, as influenced by soil moisture regimes.

	Soil moisture regimes																			
	.30 SMT/Atm					.60 SMT/Atm					Rainfall					Cultivar means				
Harvest Dates	K	C	A	N	Mean	K	C	A	N	Mean	K	C	A	N	Mean	K	C	A	N	Mean
July 8	1.74	1.00	.92	1.45	1.28	1.94	.99	.90	1.07	1.23	1.11	.73	.42	.52	.70	1.60	.91	.74	1.01	1.06
July 17	2.46	1.40	.94	1.08	1.47	3.68	1.26	1.14	1.33	1.85	1.70	1.17	1.20	1.31	1.35	2.61	.94	1.09	1.25	1.56
July 26	1.28	1.00	.46	.94	.92	1.54	1.45	.91	1.39	1.32	1.71	.53	.74	.75	.93	1.51	1.00	.71	1.03	1.06
Grand means	1.83	1.13	.77	1.16	1.14	2.39	1.23	.98	1.26	1.47	1.51	.81	.79	.86	.99	1.91	1.06	.85	1.09	1.23

LSD 5% Irr=.32 C=.37 Har=.32 IxC=NS IxH=NS CxH=.64 IxCxH=1.11

K = Kennebec A = Anoka

C = Irish Cobbler N = Norchip

significant differences occurred between Kennebec and Norchip cultivars. At third harvest, a significant difference occurred only between Kennebec and Anoka. Kennebec cultivar had significantly greater vine weight at second harvest than at first or third.

A significant interaction in vine dry weight occurred between cultivars, dates and irrigation treatment. Kennebec cultivar had significantly greater vine dry weight with .60 SMT/Atm at second harvest than any other cultivar under any treatment, at the three harvest dates. Kennebec cultivar at second harvest with .30 SMT/Atm had significantly greater vine dry weight than Anoka and Norchip.

Total weight of tubers. Yield was significantly influenced by irrigation treatments (Table 6). Tuber weight from .60 SMT/Atm was significantly higher than from the other two treatments. Plants from .30 SMT/Atm treatment had significantly higher yield than plants from the nonirrigated treatment.

Significant differences occurred in total weight of tubers between cultivars. Kennebec and Irish Cobbler cultivars produced significantly higher yield than Anoka and Norchip cultivars. Anoka had significantly less yield than Norchip.

Total weight of tubers differed significantly due to different harvest periods. The second and third harvests yielded significantly more tubers than the first harvest. A significant interaction occurred between irrigation treatments and harvests. Plots with the .30 SMT/Atm (high irrigation

Table 6. Total weight of tubers (lb per plot) of four potato cultivars harvested at ten days intervals, as influenced by soil moisture regimes.

Harvest dates	.30 SMT/Atm					.60 SMT/Atm					Rainfall					Cultivar means				
	K	C	A	N[1]	Mean	K	C	A	N	Mean	K	C	A	N	Mean	K	C	A	N	Mean
July 8	30.0	33.1	27.2	29.6	30.0	26.2	27.9	23.8	26.0	26.1	18.6	21.6	16.9	16.2	18.3	24.9	27.5	22.7	24.0	24.8
July 17	35.9	39.4	26.7	33.0	33.7	38.9	40.7	31.7	38.8	37.5	30.6	26.9	24.1	27.5	27.3	35.1	35.7	27.5	33.1	32.8
July 26	38.0	32.2	24.1	31.9	31.6	47.0	47.2	34.7	43.1	43.0	28.4	24.7	20.8	24.2	32.7	37.7	34.7	26.5	33.1	33.0
G.Means	34.6	34.9	26.0	31.5	31.8	37.3	38.6	30.1	36.1	35.5	25.9	24.4	20.6	22.6	23.4	32.6	32.6	25.6	30.1	30.2

LSD 5% Irr = 1.4 C= 1.6 Har=1.4 IxC=NS IxH=2.5 CxH=2.8 IxCxH=NS

[1] K = Kennebec A = Anoka

C = Irish Cobbler N = Norchip

treatment) had significantly higher yield at second harvest than at first harvest. Total tuber weight from .60 SMT/Atm treatment (low irrigation treatment) were significantly higher at third harvest than at the first or second harvest. The same ranking was obtained from non irrigation and harvest treatment. A significant interaction occurred between harvests and cultivars. At the first harvest, Irish Cobbler cultivar had significantly higher total tuber weight than either Anoka or Norchip cultivars. At the second harvest, Anoka had significantly lower yield than the other cultivars. The Kennebec cultivar had significantly higher yield than all other cultivars at third harvest, and Anoka had significantly less yield.

Weight of U. S. No. 1 tubers. Yield was significantly increased by irrigation levels (Table 7). Plants from .60 SMT/Atm treatment produced significantly greater weight of U. S. No. 1 tubers than plants from other treatments. Plants from .30 SMT/Atm treatment produced significantly greater weight of U. S. No. 1 tubers than plants from the rainfall treatment. Significant differences in weight of U. S. No. 1 tubers occurred between cultivars. Kennebec and Irish Cobbler cultivars produced significantly greater weight of U. S. No. 1 tubers than Anoka or Norchip cultivars. No significant differences occurred between Kennebec and Irish Cobbler or between Anoka and Norchip. Weight of U. S. No. 1 tubers differed significantly due to harvest dates. Yields from the second and third harvests were significantly higher than from the first harvest.

Table 7. Weight of U. S. No. 1 tubers (lb per plot) of four potato cultivars harvested at ten days intervals, as influenced by soil moisture levels.

Harvest dates	Soil moisture regimes																			
	.30 SMT/Atm					.60 SMT/Atm					Rainfall					Cultivar means				
	K	C	A	N	Mean	K	C	A	N	Mean	K	C	A	N	Mean	K	C	A	N	Mean
July 8	25.5	27.6	23.3	23.6	25.0	22.0	24.6	18.2	16.9	20.4	14.8	14.2	11.1	6.1	11.6	20.8	22.2	17.5	15.5	19.0
July 17	31.7	33.8	20.7	25.8	28.0	34.3	32.2	24.4	28.5	29.9	22.6	21.3	16.8	14.2	18.7	29.5	29.1	20.6	22.8	25.5
July 26	30.3	26.5	19.3	25.0	25.3	40.0	40.2	25.2	32.4	35.7	21.2	17.2	11.8	11.0	15.3	30.5	28.0	18.7	22.8	25.0
G.Means	29.1	29.3	21.1	24.8	26.1	32.1	32.3	22.6	25.9	28.3	19.5	17.6	12.1	10.4	15.2	26.9	26.4	19.0	20.4	23.2

LSD 5% Irr=1.4 C=1.6 Har=1.4 IxC=2.8 IxHar=2.5 CxHar=2.8 IxCxH=NS

Nowchip cultivar produced significantly higher yield of U. S. No. 1 tubers than Anoka at .30 and .60 SMT/Atm but no significant differences occurred between them for the nonirrigation treatment.

A significant interaction occurred between irrigation treatments and harvests. Plants from .30 and .60 SMT/Atm treatments produced significantly greater weight of U. S. No. 1 tubers than plants from nonirrigation treatments at the three different harvest periods.

At first harvest, plants from .30 SMT/Atm produced significantly greater weight of U. S. No. 1 tubers than plants from .60 SMT/Atm, but at third harvest, plants from .60 SMT/Atm treatment produced significantly greater weight of U. S. No. 1 tubers than plants from .30 SMT/Atm. No significant differences occurred at second harvest for plants from the .30 or .60 SMT/Atm treatments.

Plants from .30 SMT/Atm yielded significantly higher weight of U. S. No. 1 tubers at second harvest than plants from either first or third harvests. No significant differences occurred between plants from first and third harvests at the same levels of moisture. Plants from .60 SMT/Atm produced significantly higher yields of U. S. No. 1 tubers at third harvest than at first or second, and at second more than at first. Nonirrigation (rainfall) treatment plants produced significantly greater weight of U. S. No. 1 tubers at second harvest than plants at first or third harvest; plants at third harvest produced

significantly higher U. S. No. 1 tubers than plants at first harvest.

A significant interaction occurred between cultivars and harvests. Kennebec and Irish Cobbler plants produced significantly greater weight of U. S. No. 1 tubers than either Anoka or Norchip plants at any harvest date. Norchip plants produced significantly higher yields of U. S. No. 1 tubers than Anoka plants at third harvest. Irish Cobbler, Kennebec and Norchip cultivars at the second and third harvests produced significantly higher yields of U. S. No. 1 tubers than at the first harvest. Anoka plants produced significantly higher yields of U. S. No. 1 tubers from the second harvest than from the first harvest.

Specific gravity of U. S. No. 1 tubers. Specific gravity did not differ significantly due to irrigation treatments (Table 8). Significant differences in specific gravity occurred among cultivars. Irish Cobbler and Norchip tubers were significantly higher in specific gravity than either Kennebec or Anoka tubers. Ten days harvest intervals also significantly influenced specific gravity. Tubers from first and third harvests were significantly higher in specific gravity than tubers from second harvest. A significant interaction in specific gravity occurred between irrigation treatments and harvests. Tubers at second harvest from the low irrigation treatment (.60 SMT/Atm) were significantly higher in specific gravity than either the high irrigation treatment (.30 SMT/Atm) or nonirrigation (rainfall), but no significant difference in specific gravity occurred

Table 8. Specific gravity of four potato cultivars harvested at ten days intervals as influenced by soil moisture levels.

Harvest dates	Soil moisture regimes																			
	.30 SMT/Atm					.60 SMT/Atm					Rainfall					Cultivar means				
	K	C	A	N	Mean	K	C	A	N	Mean	K	C	A	N	Mean	K	C	A	N	Mean
July 8	73[1/]	84	78	85	80	81	90	77	87	86	79	85	78	85	82	78	86	78	86	82
July 17	74	83	70	87	79	81	86	71	87	81	76	81	75	78	78	77	83	72	84	79
July 26	81	88	76	84	82	74	83	70	83	78	70	86	70	80	77	75	86	86	82	82
G.Means	76	75	75	85	80	80	86	73	86	82	75	84	74	81	79	77	85	78	84	81

LSD 5% I=NS C=0.002 Har=0.002 IxC=NS IxHar=.004 CxH=NS IxCxHar=NS

1/ 1.0 omitted in each specific gravity determination

between tubers from either .30 SMT/Atm or nonirrigation. At third harvest, tubers from .30 SMT/Atm were significantly higher in specific gravity than tubers from either .60 SMT/Atm or nonirrigation treatments. Tubers from .60 SMT/Atm were significantly higher in specific gravity at first harvest than from either second or third harvests. Under nonirrigation (rainfall) tubers were significantly higher in specific gravity at first harvest than at either second or third harvests.

Initial chip color. Chip color did not significantly differ due to irrigation treatment (Table 9). Chip color varied significantly among cultivars. Norchip tubers produced a significantly higher chip color value than either Irish Cobbler or Anoka. Kennebec tubers had significantly lighter chip color than Irish Cobbler but no significant differences occurred among Kennebec, Anoka or Norchip tubers.

Chip color after ten days storage. Chip color did not differ significantly due to irrigation treatments (Table 10). Significant differences did occur among cultivars. Norchip tubers had significantly lighter chip color than the other cultivars. Anoka and Kennebec tubers had significantly lighter chip color than Irish Cobbler.

Harvest dates did not significantly influence chip color. A significant interaction occurred between irrigation treatments and harvests. Tubers at first harvest produced significantly lighter chip color under .60 SMT/Atm and nonirrigation treatments than tubers under .30 SMT/Atm, and no significant

Table 9. Chip color (initial) of four potato cultivars harvested at ten days intervals, as influenced by soil moisture levels (Higher readings indicate a lighter colored chip).

	Soil moisture regimes																			
	.30 SMT/Atm					.60 SMT/Atm					Rainfall					Cultivar means				
Harvest dates	K	C	A	N	Mean	K	C	A	N	Mean	K	C	A	N	Mean	K	C	A	N	Mean
July 8	29.7	29.0	29.0	37.7	31.4	31.3	34.0	36.7	35.7	34.2	36.0	30.7	36.3	37.7	35.2	32.3	31.2	34.0	37.0	33.6
July 17	31.0	31.0	31.0	33.0	31.4	29.3	26.0	31.7	33.7	30.2	36.0	30.7	33.0	37.0	34.2	32.1	29.2	31.9	34.6	32.0
July 26	34.7	33.3	30.7	33.3	33.0	33.7	32.7	28.7	33.7	32.2	35.0	29.7	31.3	31.3	31.8	34.4	31.9	30.2	32.8	32.3
G.Means	31.4	31.1	30.2	34.7	32.0	31.4	30.9	32.4	34.4	32.2	35.7	30.4	33.5	35.3	33.7	33.0	30.8	32.0	34.7	32.6

LSD 5% Irr=NS C=2.1 Har=NS IxC=NS IxH=NS CxH=NS IxCxH=NS

Table 10. Chip color (after ten days storage) of four potato cultivars, harvested at ten days intervals, as influenced by soil moisture levels.

	Soil moisture regimes																			
Harvest	.30 SMT/Atm					.60 SMT/Atm					Rainfall					Cultivar means				
dates	K	C	A	N	Mean	K	C	A	N	Mean	K	C	A	N	Mean	K	C	A	N	Mean
July 8	27.7	21.7	29.3	31.7	27.6	31.0	29.3	33.0	39.0	33.1	31.0	30.7	32.7	36.7	32.8	29.9	27.2	31.7	35.8	31.2
July 17	25.7	29.0	31.0	34.0	29.9	28.0	25.7	31.3	33.7	29.7	31.0	26.3	28.7	35.3	30.3	28.2	27.0	30.3	34.3	30.0
July 26	33.7	31.0	28.7	34.7	32.0	33.0	29.7	27.0	32.7	30.6	28.3	25.0	30.0	33.0	29.1	31.7	28.6	28.6	33.4	30.6
G.Means	29.0	27.2	29.7	33.5	29.9	30.7	28.2	30.4	35.1	31.1	30.1	27.3	30.5	35.0	30.7	29.9	27.6	30.2	34.5	30.5

LSD 5% Irr=NS C=1.6 Har=NS IxC=NS IxH=2.4 CxH=NS IxCxH=NS

difference in chip color occurred between tubers from either 0.60 SMT/Atm or nonirrigation. At third harvest, tubers from .30 SMT/Atm produced significantly lighter chip color than tubers from either .60 SMT/Atm or nonirrigation treatments.

Tubers from .30 SMT/Atm plots had significantly lighter chip color at third harvest than from either the first or second harvests. Tubers from .60 SMT/Atm plots, had significantly lighter chip color at first harvest than from either second or third harvests. Tubers under nonirrigation treatment (rainfall) had a significantly lighter chip color at first harvest than either the second or third harvest.

Chip color reversion. Chip color reversion was significantly influenced by cultivars Table 11. Kennebec and Irish Cobbler tubers significantly reverted more than Norchip.

DISCUSSION OF RESULTS

The results of this experiment indicated that vine dry weight, total weight of tubers, and U. S. No. 1 tubers were influenced by supplemental irrigation.

Vine dry weight. Highest occurred from the irrigated plots than from the nonirrigated plots (rainfall only). This agrees with the findings of Bradley and Pratt (3) that maintaining a high moisture level resulted in better top growth, earlier tuber set and greater weight of tubers. The Kennebec cultivar produced the highest vine dry weight of the cultivars studied,

Table 11. Chip color reversion of four potato cultivars harvested at ten days intervals, as influenced by soil moisture levels.

	Soil moisture										Tensions/Atmosphere									
	.30 SMT/Atm					.60 SMT/Atm					Rainfall					Cultivar means				
Harvest dates	K	C	A	N	Mean	K	C	A	N	Mean	K	C	A	N	Mean	K	C	A	N	Mean
July 8	2.0	7.3	-.3	5.6	3.8	.3	4.6	3.6	3.3	1.3	5.0	0.0	3.6	1.0	2.4	2.4	4.0	2.3	1.2	2.5
July 17	5.3	2.0	0.0	-1.0	1.6	1.3	.3	.3	0.0	0.5	5.0	4.3	4.3	1.6	3.8	3.8	2.2	1.6	.22	1.2
July 26	1.0	2.3	2.0	-1.3	1.0	0.6	3.0	1.6	1.0	1.6	6.6	4.6	1.3	-1.6	2.8	2.8	3.3	1.6	-.6	1.8
G.Means	2.8	5.0	.5	1.2	2.1	.7	2.6	1.8	-.7	1.1	5.6	3.0	9.3	.3	3.0	3.0	3.2	1.8	.2	2.1

LSD 5% Irr=NS C=1.8 H=NS IxC=NS IxH=NS CxH=NS IxCxH=NS

(Plate III). Vine dry weight increased at second harvest and then decreased, due to the beginning of plant senescence and abscission of older leaves. Plate III (Fig. 2) shows that Kennebec had greater vine dry weight than the other cultivars at the second harvest and then decreased later in the season. However, vine weight was still higher than the maximum of the other cultivars. Vine dry weight of Irish Cobbler cultivar did not differ significantly due to harvest dates.

Total tuber weight. Weight per plot was significantly influenced by irrigation levels. The .60 SMT/Atm irrigation plots produced more tuber weight than the .30 SMT/Atm or nonirrigation plots (Plate II, Fig. 1). The nonirrigated plots produced the least tuber weight. This agrees with Fulton and Murwin (13) who reported that irrigation water applied to early potatoes when the SMT reached 0.30 Atm. was no more effective than irrigation when SMT reached 0.60 Atm. They also observed that irrigation at this soil moisture tension level produced higher yield than irrigation at higher tension level. Motes (29) showed that vine dry weight and tuber weight were increased by supplemental irrigation. He also observed that optimum irrigation level for vine dry weight and tuber weight varied between years.

Jones and Johnson (20) reported that higher yield, both total tuber weight and U. S. No. 1, resulted when potatoes were irrigated when soil moisture tension reached 0.30 SMT/Atm. Struchtemeyer et al. (44), Jacob et al. (18) and Pratt (32)

reported that high yield was obtained when the soil moisture level was 50 percent of field capacity. Greater weight of tubers occurred at the second harvests for Irish Cobbler, Anoka, and Norchip and then decreased slightly at the third harvest (Plate II, Fig. 2).

The Kennebec cultivar vines remained green longer and total tuber weight increased until the third harvest. This possibly was due to the later maturity of the Kennebec cultivar allowing it to increase its tuber weight after the senescence of the other cultivars. These results agree with Clark (6) who reported that variations of cultivars is directly related to earliness or lateness of maturity. He observed that the entire crop of tubers are set at the beginning of the period of tuber development with a slight increase in number of tubers for a few weeks and a subsequent decreases later in the season. A comparison of total weight of tuber with vine dry weight indicates that these two factors had a similar pattern for all varieties studied except Kennebec.

Weight of U. S. No. 1 tubers. Tuber weight was higher with .60 SMT/Atm irrigation than with either .30 SMT/Atm or nonirrigation treatment, but the latter produced the least (Plate II, Fig. 3). This agrees with Bradley and Pratt (3) who reported that an increase in number of tubers over 2 inches in diameter with irrigation in one growing season while the average size of tuber did not vary significantly. They found that in the following growing season, the major effect of irrigation was to increase the average size of tubers above two inches,

which is clearly reflected in this study.

Robins and Domingo (35) reported that yield of U. S. No. 1 tubers was reduced from 17 to 58 percent by soil moisture stress treatments. Kennebec and Irish Cobbler plants produced a greater weight of U. S. No. 1 tubers than Anoka and Norchip with all irrigation treatments. All four cultivars studied produced lowest weight at the first harvest (Plate II, Fig. 4). At third harvest, weight of U. S. No. 1 tubers decreased slightly for all the cultivars except Kennebec which had a slight increase in weight. This was due to its late maturity and increase in tuber size.

Specific gravity of tubers. Specific gravity did not differ with irrigation levels for the cultivars studied. This agrees with Fulton and Findlay (14) who found that the dry matter of tubers was not influenced by the application of irrigation water. Jacob, *et al.* (18) obtained no significant differences in specific gravity with different soil moisture levels. Kennebec and Norchip decreased in specific gravity as the season progressed. This was probably due to increased respiration of later maturing cultivars. Anoka decreased in specific gravity at second harvest and then sharply increased at the end of the season, the same applied to Irish Cobbler which increased but slightly (Plate III, Fig. 4). Irish Cobbler and Anoka cultivars had higher specific gravity at the end of the season than either Kennebec or Norchip cultivars. An interaction between irrigation levels and harvests reveals

that the .30 SMT/Atm produced higher specific gravity at the end of the season than .60 SMT/Atm and nonirrigation treatments. Specific gravity was higher with .60 SMT/Atm at first harvest than either .30 SMT/Atm or nonirrigation, after which it decreased. This was probably due to higher temperature and higher respiration (Figure 8). This agrees with Murphy and Govens (30) who reported that low soil moisture levels and high temperature adversely affected specific gravity. Specific gravity decreased to the second harvest, and then increased at the last harvest. Soil temperature and air temperature (Plate I, Fig. 2) both increased between the first and second harvest. Murphy and Govens (30), Motes (29), and Yamaguchi _et al_. (49) all found specific gravity decreased as soil temperature increased.

Initial chip color. Norchip tubers produced lighter colored chips at the first harvest followed by Anoka, but as the season progressed chip color decreased. Kennebec and Irish Cobbler tubers produced darker colored chips at the first harvest than Norchip, but at the end of the season their values increased to produce lighter chip color (Plate IV, Fig. 1). No significant difference occurred between cultivars in producing light chips at the third harvest (end of the season).

Kushman _et al_. (22) and Hope _et al_. (17) have shown that tubers dug in the immature state produced darker chips and uneven colored chips. This agrees partially with results for Kennebec and Irish Cobbler (Plate IV) but not with the findings for

Norchip or Anoka because chip color of these two cultivars decreased as the season progressed. This may have been due to earlier maturity of tubers than the other two cultivars. Results obtained with Irish Cobbler reflects what Clegg and Chapman (7) observed. They found that Irish Cobbler tubers produced darker colored chips when dug in immature state. It seems that there is no relationship between chip color and specific gravity of these four cultivars studied (Plate III and IV). This agrees with recent reports which indicate that the two characters of specific gravity and chip color rating are inherited independently, Cunningham and Stevenson (9).

Lyman and Mackay (26) observed that tubers of high specific gravity consistently produce chips of lighter color than tubers of low specific gravity. Their observation disagrees completely with results obtained by other investigators and in this study. Ng (31) showed that high specific gravity tubers do not always insure good color chips, and that cultivar is very important. Motes (29) found that specific gravity was not correlated with chip color. The results of these studies showed that fluctuation in the chemical balance of the tubers due to variety, maturity, storage period, temperature and other factors influence chip color.

Chip color after storage. After 10 days storage at 70° F, Norchip tubers produced lighter colored chips than all other cultivars studied regardless of harvest date. Kennebec tubers followed the same trend as that before storage period. It

produced lighter colored chips at third harvest than either at first or second. Smith (40) obtained high quality colored chips from Kennebec tubers. Anoka showed a decrease in chip color values as the season progressed. Irish Cobbler increased slightly in chip color but it did not reach the level of producing acceptable colored chips (Plate IV, Fig. 2). Clegg and Chapman (7) found that during storage, regardless of temperature, reducing sugars increased and the potato chips became darker, and this reaction occurs more rapidly and progresses further when the potatoes are harvested immature. Results obtained with Irish Cobbler and Kennebec tubers agrees with Clegg and Chapman (7). At the end of storage period, Irish Cobbler produced unacceptable chips whether they were from mature or immature tubers at the three different harvest dates. Heinze (15) found that when early crop potatoes are used for processing, particularly for chip making, their storage temperature requirements differ considerably from those for late-crop potatoes. Clegg and Chapman (7) found that the color of chips from the early maturing variety (Cobbler) from tubers stored at 50° F was considerably darker than those stored at 70 and 90° F. They found that the mean chip color became increasingly lighter straw colored particularly early in the harvest season when potatoes were immature. This conflicted with the observations on Irish Cobbler from this study. After 10 days storage at 70° F tubers from Irish Cobbler cultivar produced darker chips than before storage. This indicates that the choice of cultivars

is essential to good storage management. Some cultivars have very poor storage characteristics, such as Irish Cobbler in this study, and some others have good storage life such as the Norchip cultivar. Shallenberger (36) observed that not only was storage temperature the main factor influencing potato chip color, but cultivar, length of storage and maturity were also significant.

An interaction occurred between harvests and irrigation levels on chip color after storage. It showed that .60 SMT/Atm and nonirrigation treatments produced lighter colored chips at first harvest (immature tubers), and that .30 SMT/Atm produced unacceptable chips at the same harvest (Plate IV, Fig. 3). Tubers from the last harvest produced lighter chips under .30 SMT/Atm than either .60 SMT/Atm or nonirrigation treatments and the latter produced unacceptable colored chips. This was probably due to high temperature of the soil late in the season. When the soil was well supplied with moisture (0.30 SMT) during this period of hot weather a lower soil temperature occurred which resulted in lighter chip color.

Chip color reversion. Irish Cobbler showed a relatively less degree of reversion at second harvest than at the either first or third harvest (Plate IV, Fig. 4). Kennebec reverted at second harvest greater than either at the first or third harvest. Anoka tubers showed a relatively high degree of reversion at first harvest and it decreased at second harvest. Norchip tubers were the lowest in reversion of all cultivars.

They reverted considerably at first harvest but reversion decreased as the season progressed. At the end of the season tubers of Norchips produced lighter chips after storage period at 70° F than tubers chipped directly after harvest. Obviously, cultivar, harvest date, soil temperature, storage period, and some other factors are highly significant in influencing chip color. This agrees with Beale, et al. (2) who reported that in all tests conducted, there were highly significant differences between cultivars, temperature, dates of chipping, and the interaction between dates and temperatures in chip color reversion. They found that potato breeding lines differed in chip color reversion from harvest to 10 days after harvest.

SUMMARY

Tuber yield and vine dry weight

The total weight of tubers, U. S. No. 1 tubers and vine dry weights were influenced significantly by supplemental irrigation treatments. Maintaining a low moisture level .60 SMT/Atm resulted in more top growth, greater weight of tubers and greater weight of U. S. No. 1 tubers than was the case with either a high moisture .30 SMT/Atm or nonirrigation levels. Yield of tubers at .60 SMT/Atm was greater at third harvest (the end of the season) than from the first or second harvests. Tuber yield increased after the first harvest and then remained constant for the other two harvests. Kennebec

EXPLANATION OF PLATE II

Fig. 1 Mean total weight of tubers per plot of four cultivar grown under high irrigation, low irrigation, rainfall levels.

Fig. 2 Mean total weight of tubers per plot of four cultivars at ten days harvest intervals.

Fig. 3 Mean weights of tubers per plot greater than 2 inches in diameter (U. S. No. 1) of four cultivars grown under high, low, rainfall levels.

Fig. 4 Mean weights of tubers per plots greater than 2 inches in diameter (U. S. No. 1) of four cultivars at ten days harvest intervals.

PLATE II

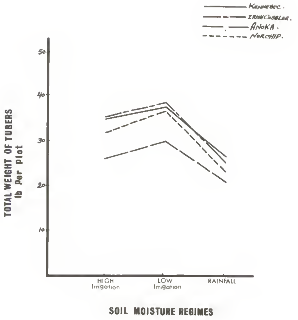


Figure I

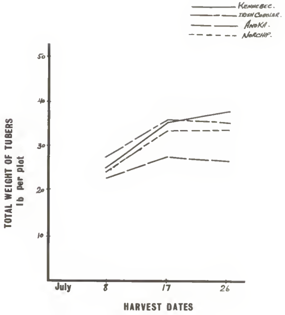


Figure 2

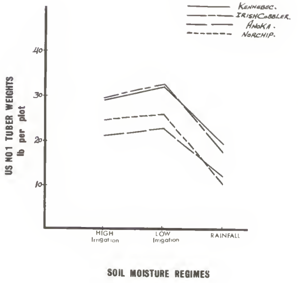


Figure 3

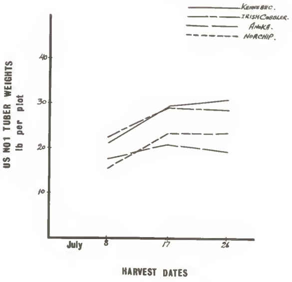


Figure 4

EXPLANATION OF PLATE III

Fig. 1 Mean vine dry weight of four cultivars grown under high, low and rainfall levels.

Fig. 2 Mean vine dry weight of four cultivars at ten day harvest intervals.

Fig. 3 Mean specific gravity of tubers of four cultivars grown under high, low and rainfall levels, at ten day harvest intervals.

Fig. 4 Mean specific gravity of tubers of four cultivars at ten day harvest intervals.

PLATE III

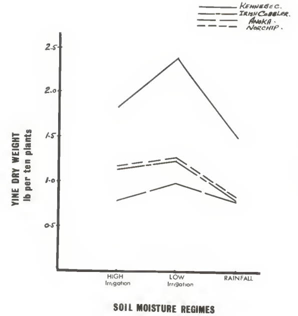
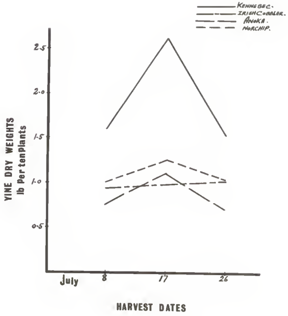


Figure 1



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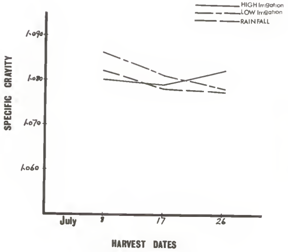

Figure 3

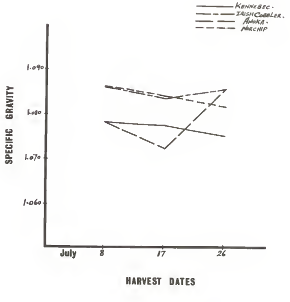

Figure 4

EXPLANATION OF PLATE IV

Fig. 1 Mean initial chip color of four cultivars at ten days harvest intervals.

Fig. 2 Mean chip color of four cultivars after 10 days storage at 70° F and 85% relative humidity, at ten days harvest intervals.

Fig. 3 Mean chip color of four cultivars after 10 days storage at 70° F and 85 percent relative humidity, and grown under high, low, and rainfall levels, at ten days harvest intervals.

Fig. 4 Mean chip color reversion of four cultivars at ten days harvest intervals.

PLATE IV

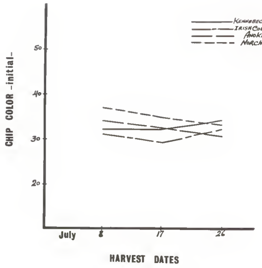

Figure 1

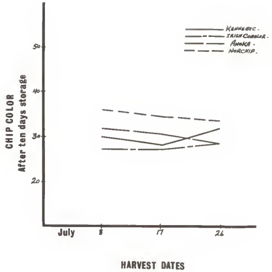

Figure 2

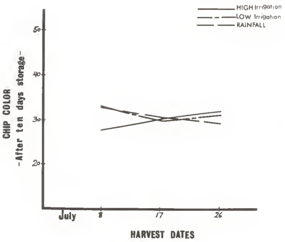

Figure 3

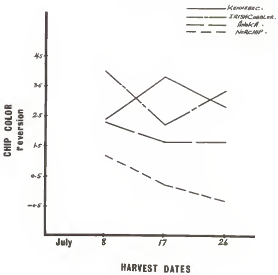

Figure 4

Kennebec and Irish Cobbler cultivars produced more total tuber weight than Norchip. This cultivar produced more than Anoka. Kennebec produced greater vine dry weight than any other cultivar. Irish Cobbler and Norchip cultivars produced more vine dry weight than Anoka. Kennebec and Irish Cobbler produced a greater weight of U. S. No. 1 tubers than either Anoka or Norchip.

Specific gravity

Tubers produced at low irrigation level .60 SMT/Atm had higher specific gravity at first harvest than at either high irrigation level (.30 SMT/Atm) or nonirrigation level. As the season progressed, specific gravity of tubers produced under .60 SMT/Atm and nonirrigation levels decreased. Under .30 SMT/Atm irrigation specific gravity of tubers increased.

Irish Cobbler and Anoka tubers had higher specific gravity than Kennebec or Norchip at the final harvest.

Chip color

Freshly harvested tubers of Kennebec and Norchip cultivars produced lighter chips than Irish Cobbler or Anoka. After 10 days storage at 70° F and 85 percent relative humidity, Norchip tubers produced significantly lighter chips than either Kennebec or Anoka. Anoka produced significantly lighter chips than Irish Cobbler. Tubers of lower specific gravity cultivars

produced lighter colored chips than those of high specific gravity. After the storage period, chip color values of tubers under .60 SMT/Atm and nonirrigation levels decreased after the first harvest (dark colored chips) and remained constant until the end of the season. However, it increased for tubers under 0.30 SMT as the season progressed (light colored chips). Maturity of tubers did not influence the chip color after storage period.

Norchip tubers reverted significantly less than either Kennebec or Irish Cobbler and slightly less than Anoka. Anoka tubers reverted less than Kennebec or Irish Cobbler. Harvest dates did not significantly influence chip color reversion.

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RESPONSE OF POTATO (Solanum tuberosum)
CULTIVARS TO IRRIGATION LEVELS AND HARVEST DATES

by

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AN ABSTRACT OF A MASTER'S THESIS

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A factorial study was conducted in 1968 to examine the response of Kennebec, Irish Cobbler, Anoka and Norchip cultivars to various soil moisture treatments and different harvest dates. Uniform seed pieces were planted March 25, 1968, on a Sarpy fine sandy loam soil. Soil moisture blocks were irrigated when the average 6 and 12 inch soil moisture tension readings were 0.30 and 0.60 atmospheres. A completely randomized design was used. Rainfall for the seven weeks period, when differential irrigation was used, was 5.51 inches. Thirty six plots were harvested at 10 days intervals: July 8, 17 and 26. Fresh and dry weight of vines from ten plants was recorded for each plot. Total weight and weight of U. S. No. 1 tubers was recorded. Specific gravity of tubers was determined by the weight in air - vs weight in water method. Chip color was determined from freshly harvested tubers and from tubers after 10 days storage at 70° F and 85 percent relative humidity.

The results of this study revealed that, total weight of tubers, U. S. No. 1 tubers, and vine dry weight were the factors influenced by supplemental irrigation. Optimum irrigation level for high yield and best top growth was when the soil reached 0.60 SMT referred to as low irrigation level. Total weight of tubers and U. S. No. 1 tuber weight increased to a maximum at harvest 3 (last harvest) under 0.60 SMT. Vine dry weight increased at second harvest and then declined as the season progressed under 0.60 SMT. Cultivars under 0.60 SMT

produced tubers with higher specific gravity although differences were not significant. Specific gravity was highest under the 0.60 SMT level at the first harvest and then decreased as the tubers matured. Initial chip color, after 10 days storage, and chip color reversion was not influenced by supplemental irrigation treatment.

It was concluded that the response of potatoes to various soil moisture levels and the influence of harvest dates differ among cultivars. Kennebec and Irish Cobbler cultivars produced the greatest total weight of tubers and U. S. No. 1 tuber weight and Anoka produced the least. Kennebec produced the greatest vine dry weight. The highest specific gravity was produced by Irish Cobbler and Norchip cultivars, and Kennebec had the lowest. Norchip produced lighter colored chips (initially and after storage) and reverted less than other cultivars. Kennebec and Irish Cobbler showed a high degree of reversion and produced dark chips after storage period. Specific gravity did not appear to be correlated with chip color.